"essentially agrees with these views."[31] The agency therefore called the rules "interim," not wishing to prejudge the direction of technology.

The Commission's interim rules provided for AVM systems to be operated in several bands below 512 MHz and in the 902-928 MHz bands (902-912 MHz and 918-928 MHz). The FCC cautioned, however, that although the interim rules provided for "authorization of AVM systems on a regular basis," the industry was still in an "early stage of development."[32] As a consequence, the agency emphasized that

> the rule changes being adopted are necessarily only interim provisions that incorporate tentative standards for conforming AVM systems to present land mobile operational requirements and allow for continued technological advancement in the different techniques involved.[33]

Thus, the FCC stated that its interim provision for the operation of AVM systems in the 904-912 and 918-926 MHz bands was intended to be "in keeping with our objective of allowing full scope for development of AVM techniques."[34] Rather than mandate or enshrine a particular type of technology or application, therefore, the agency determined to permit the public -- through the action of the marketplace -- to nurture

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[31] Interim Order at 28,881, ¶ 5. The Commission, in expressing its agreement with the consensus for liberality, quoted extensively from the comments of the American Transit Association, which "urge[d] the Commission to be flexible in its approach, and to attempt to provide for a multiplicity of needs which may vary from user to user." Interim Order at 28,881, ¶ 4.

[32] Interim Order at 28,881 ¶ 5.

[33] Id. (emphasis added).

[34] Id. at 28,883, ¶ 10.

competing systems, with competing designs and varying applications, thus satisfying developing and not fully foreseeable needs.

Of course, by their very nature, the Commission's interim rules required AVM licensees to share the allotted spectrum. Current FCC rule 90.173(a), whose antecedents were in place at the time of the 1974 Interim Order,[35] provides unequivocally that "[e]xcept as otherwise specifically provided in this part, frequencies assigned to land mobile stations are available on a shared basis only and will not be assigned for the exclusive use of any licensee."[36] Section 90.239 nowhere specifies that exclusivity was contemplated and, accordingly, AVM systems were required to cooperate with each other to avoid mutual interference. As a result, no AVM licensee has a superior position in relation to any other licensee.

Such spectrum sharing was consistent with the agency's cautious, interim approach to AVM development. Sharing would permit entities to try different AVM concepts simultaneously and thereby to advance AVM techniques. Indeed, FCC policy at the time of the adoption of the rules long favored service sharing as a method to allow competitive, multiple entry and obtain the maximum use of scarce spectrum resources.[37] The Commission's consistent policy of reliance on marketplace forces to

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[35] See 47 C.F.R. § 89.101(a) (1973); 47 C.F.R. § 91.8(a) (1973); 47 C.F.R. § 93.8(a) (1973).

[36] 47 C.F.R. § 90.173(a) (1991).

[37] See, e.g., Land Mobile Use of TV Channels 14 through 20, 23 F.C.C.2d 325, 329 (1970) (citing sharing as a reason for the "unparalled" growth of land mobile services); Frequency Allocations-450-470 Mc/s Band, 10 F.C.C.2d 885, 894 (1967) (favoring the maximum possible sharing).

select technology[38] and on spectrum sharing to increase efficiency has been reaffirmed in a host of other areas throughout the ensuing 20 years[39] and, in the case of land mobile services, is enshrined in Section 332 of the Act.[40]

In sum, in 1974, the Commission believed that the adoption of rules designed to promote the "full scope" of AVM technological development would allow AVM to

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[38] Cf. Allocation of the 849-851/894-896 MHz Bands, 5 F.C.C. Rcd 3861 (1990) (adopting a flexible, open entry approach where applicants chose the appropriate technology).

[39] Establishment of a Pioneers Preference, 6 F.C.C. Rcd 3488, 3492 (1991) (noting that an applicant could be rewarded for "proposals that promise to enable the sharing, or co-use, of allocated spectrum."); Statement of Thomas P. Stanley, Chief Engineer, before the Senate Subcommittee on Communications at 3 (Aug. 2, 1990) ("Of necessity, we have come to promote spectrum saving technologies and spectrum sharing, to make the most of the spectrum available."); Frequency Coordination in Private Land Mobile Radio, 4 F.C.C. Rcd 6325, 6325 (1989) ("the sharing of frequencies is a critical element in the efficient use of the spectrum."); Telephone Maintenance Radio Service, 60 Rad. Reg. 2d (P & F) 1503, 1509 (1986) ("[i]t is our experience. . .that the sharing of a limited number of channels among similar users optimizes the efficient use of the spectrum.").

[40] Section 332(a) of the Communications Act requires the Commission, when addressing private land mobile spectrum issues, to:

> improve the efficiency of spectrum use and reduce the regulatory burden upon spectrum users, based upon sound engineering principles, user operational requirements, and market-place demands; encourage competition and provide services to the largest feasible number of users; [and] increase interservice sharing opportunities.

47 U.S.C. § 332(a)(2-4) (1988) (emphasis added); see also S. Rep. No. 97-191, 97th Cong., 2d. Sess. 14 reprinted in 1982 U.S. Code Cong. & Admin. News 2237, 2250 (Section 332(a) was adopted, inter alia, because "it is critical that the FCC seek out and encourage frequency sharing opportunities among [private land mobile] and other services.").

Although exclusivity may have some merit when allocating virgin spectrum and where more than merely a few channels are available, as in the cases cited by PacTel, see PacTel Petition at 26, a spectrum environment that is and will continue to be shared among several services is quite different. Here, Pactel seeks four-fifths of an already allocated and occupied AVM spectrum band for its AVM duopoly. Particularly when the market may not be fully mature, as is the case with AVM, spectrum sharing best implements the Commission's goals of fostering technological development and meeting diverse market needs.

blossom into an "essential adjunct" to land mobile operations.[41] At the same time, the FCC, consistent with its objectives and the tentative nature of the regulations, "intend[ed] continuous study of [AVM] techniques in an effort to ascertain the most productive methods in an operational framework."[42] Following such a study of actual AVM operations, the Commission expected

> then to be able to more clearly define spectrum requirements and operational standards for AVM as appropriate for future Commission action. Full information as to problems and results experienced in the practical application of AVM techniques will be necessary to this effort, and extensive comments and reports from licensees in this respect will continue to be most helpful.[43]

The Commission set no specific timetable for revisiting its AVM rules, but clearly intended to sanction ample marketplace experimentation before any permanent rules would be adopted. More final rules, and any change in the manner of spectrum allocation -- including the spectrum sharing requirement -- could only come with considerably greater industry maturity and broad consensus. At that time, the rules could be revised as necessary to accommodate, on a longer term, the AVM industry as it had in fact developed.

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[41] Interim Order, at 28,883, ¶ 15.

[42] Id. (emphasis added). The results that the FCC intended to monitor included "frequency requirements, compatibility with existing operations, . . . and other like elements of efficiency in operation." Id.

[43] Id. (emphasis added).

As noted below, AMTECH has no objection to Commission reexamination of policies for this band. Indeed, AMTECH offers some suggested approaches in Part V of these comments. However, grant of PacTel's petition would discard the public benefits now emerging from this multi-decade experimentation period in favor of freezing AVM technology at the PacTel stage -- a level that has already been bypassed by others in the industry.

B. AMTECH's Experience with the Licensing Process Confirms that Neither Exclusivity nor a Wideband/ Narrowband Distinction are in the Public Interest

PacTel proposes to restrict the 904-912 and 918-926 MHz portions of the spectrum to what it calls "wideband" systems.[44] Implicitly, PacTel assumes that AMTECH technology is so-called "narrowband." AMTECH does not believe that such labels are either useful or justified by the FCC's past oversight of AMTECH.

As noted above, the original modulated backscatter systems that were the precursor to AMTECH were first envisioned to be used as government radiolocation in the 902-928 MHz allocation. Upon transfer to the private sector, AMTECH was required to investigate options for civilian licensing. Because of the obvious commercial application of the technology involved automatic vehicle tracking, AMTECH quickly focused on the AVM rules in Section 90.239.

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[44] PacTel Petition Appendix 1 at 1.

Before its initial licensing, AMTECH personnel discussed the licensing process with FCC Private Radio Bureau staff. AMTECH explained its technology and discussed how the Form 574 applications would be completed in order to explain fully the AMTECH system. The first authorization was granted to Kerr-McGee Coal Corporation in 1986, and was, of course, on a non-exclusive basis.[45] Other applications followed. Those early applications authorized use of frequencies throughout the 904-912 MHz and 918-926 MHz bands, such as 912, 918, 904 and 926 MHz. These frequencies, of course, are in the spectrum PacTel claims was intended solely for "wideband" AVM systems.

Many of the early applications placed the illuminating signal at the band edges. Just over two years ago, Commission staff questioned whether AMTECH systems could properly be assigned frequencies on the band edges. The agency's concern was that band edge center frequencies, with a 20 kHz signal, inevitably implied some spill over into adjacent bands. After meetings with Private Radio Bureau staff in both Washington and Gettysburg and a demonstration of its technology, AMTECH proposed to shift its routinely used frequencies to, for example, 911.990, 918.010, 904.010 and 925.990 MHz, still in the alleged wideband part of the spectrum. The staff approved the change.[46]

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[45] Kerr-McGee Coal Corp. (granted Oct. 7, 1986).

[46] Letter to David Hilliard, Counsel for AMTECH, from Terry Fishel, Chief, Land Mobile Branch (Sept. 7, 1990).

At these briefings, AMTECH representatives also took the opportunity to explain the need for access to significant portions of the band, albeit with low power equipment, for three reasons. First, as described above, installation geometry (e.g., adjacent highway lanes or rail lines) and interference issues required frequency separation between adjacent readers to avoid mutual interference when multiple readers were employed at a single site. Second, systems with higher data rate requirements require greater bandwidth.[47] Third, the developing industry standards, finalized since that time, called for multiple frequencies (e.g., the AAR's requirement for 912 and 918 MHz). These facts explained the need for more than a single frequency, notwithstanding the exceptionally low interference potential of the AMTECH system.

AMTECH kept the Commission fully informed about its technology and plans. For its part, the Commission's long-standing interpretation of the rules, entitled to substantial deference,[48] has permitted modulated backscatter systems such as AMTECH into the 904-912 and 918-926 MHz bands. PacTel presents no substantial rationale for change in this policy. The FCC licensing process has been uncontroversial and -- to AMTECH's knowledge -- no complaints of interference have been submitted to the FCC.

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[47] The California Department of Transportation has recently specified such a requirement.

[48] See Chevron USA, Inc. v. NRDC, 467 U.S. 837 (1984).

IV. PACTEL'S PROPOSED RULES WOULD NOT SERVE THE PUBLIC INTEREST

A. Introduction and Burden of Proof

As the proponent of changes to existing rules, PacTel, like any petitioner, bears the burden of proof.[49] Moreover, its burden is particularly great in this case. PacTel seeks to establish a duopoly in the AVM spectrum, limiting access of other systems and services to those frequencies. As such, as discussed below, grant of PacTel's petition inevitably would foreclose new entrants and technologies as well as seriously compromising the further development and operations of existing technologies and providers. But, Section 7 of the Communications Act obligates the Commission as one of the agency's highest priorities to avoid any such result:

> It shall be the policy of the United States to encourage the provision of new technologies and services to the public. Any person or party. . .who opposes a new technology or service proposed to be permitted under this chapter shall have the burden to demonstrate that such proposal is inconsistent with the public interest.[50]

Consequently, in order to succeed with its petition, PacTel must show by clear and convincing evidence that the spectrum exclusivity it favors would not chill the growth

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[49] See American Horse Protection Ass'n, Inc. v. Lyng, 812 F.2d 1, 4-5 (D.C. Cir. 1987); WWHT, Inc. v. FCC, 656 F.2d 807, 813 n.9 (D.C. Cir. 1981), quoting Appendix to Attorney General's Statement Regarding Revised Committee Print of October 5, 1946.

[50] 47 U.S.C. § 157(a) (1988).

of AVM technology in all of its permutations, including AMTECH's, and not simply promote PacTel's own business interests.

AMTECH submits that, given the current status of AVM technology and the AVM marketplace, such a showing is impossible to make, and PacTel certainly fails. Although PacTel contends that the current AVM rules do not well serve the AVM industry and the public at large,[51] as demonstrated below, its arguments are confined to the constraints placed upon its own operations by certain technical weaknesses in its system design. PacTel fails to identify particular defects in the current rules that have denied AVM users access to the latest and best AVM technologies and applications. This is especially true of the shared spectrum requirements. In fact, the 902-928 MHz band today satisfies a wide variety of communications needs on a shared basis. Given that the purpose and thrust of the Commission's AVM regulatory scheme was to provide technological flexibility in order to realize the full potential of AVM technology, PacTel's Section 7 showing falls far short of justifying the relief it seeks.

Initially, it is important to note that, whatever action is taken on PacTel's petition, 902-928 MHz will remain a shared band. Currently, this band is allocated primarily to Industrial, Scientific and Medical (ISM) devices and governmental radiolocation. The ISM products that operate in this band[52] include industrial heating machines and medical devices. Although the specific characteristics of the government

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[51] PacTel Petition at 16-19.

[52] ISM equipment cannot offer communications services. 47 C.F.R. § 18.107(c) (1991).

radiolocation services in the band are classified, they reportedly include shipboard firecontrol radar. Moreover, the band is also allocated to the amateur services on a secondary basis to other licensed users[53] and is available for, and increasingly heavily used by, Part 15 devices, some of which operate at significantly higher field strengths than in lower bands.[54] PacTel's system will always be required to be designed to accommodate virtually limitless potential interference from ISM and other systems. Thus, it is far from clear that PacTel could obtain the exclusivity it appears to need even if the current petition were granted.

Most importantly, however, the existing sharing arrangement has, in fact, worked well, just as the Commission originally intended. Spectrum sharing has permitted operations in the band by a multitude of users. Specifically, sharing has allowed technologies such as AMTECH's to co-exist gracefully with ISM, government systems, other AVM systems, amateurs and Part 15 devices such as radio LAN units, the new generation of cordless telephones, alarm systems protecting people and property, and audio/video distribution systems. At the same time, the AVM applications described above, plus a host of others, have been developed, and the public has benefitted.

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[53] 47 C.F.R. § 97.301(a) (1991).

[54] See, e.g., 47 U.S.C. § 15.245 (1991) (permitting operation of field disturbance sensors); 47 C.F.R. § 15.247 (permitting operation of spread spectrum systems); 47 C.F.R. § 15.249 (permitting operation of general intentional radiators such as the new generation of cordless telephones now appearing in stores).

Moreover, to date, AMTECH is aware of no complaints from users other than PacTel, nor has AMTECH received interference from other users in the band. The current sharing has been a success in accommodating hundreds of thousands of users; any change in this philosophy should come only after the most compelling of public interest showings. PacTel has not established such a record here.

Such a showing justifying exclusivity cannot, for example, be derived from the experience of sharing between AMTECH and PacTel. Although low power, AMTECH's equipment is designed to accept a good deal of interference from co-frequency hyperbolic multilateration (HML) systems such as PacTel's and so has no serious problems with sharing the 902-928 MHz band. To the extent the PacTel's system has experienced interference from systems using AMTECH technology, PacTel has in the past contacted AMTECH to work out mutually satisfactory arrangements to eliminate the concern.[55] Thus, band sharing has not yet raised any significant problems, and the existing situation illustrates how parties of good will acting in good faith can virtually always resolve interference issues. Nevertheless, it is apparent that the key to successful sharing is designing sufficiently robust equipment that can survive in the shared spectrum environment and can flexibly accommodate other users, as AMTECH and others have done, but PacTel apparently has not.[56]

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[55] Most often, this has involved changing some frequencies on particular AMTECH readers. AMTECH and PacTel have cooperated without friction. To date, PacTel has compensated AMTECH or its customer/user for the costs of implementing such changes.

[56] See PacTel Petition, Appendix 2 at 4-5 (admitting that there are several untried technical solutions to PacTel's interference concerns).

For nearly 20 years under the AVM rules, spectrum sharing has been a basic requirement. AMTECH, and its users and customers as well as other manufacturers of similar equipment, have taken advantage of the opportunities secured by those rules and have spent substantial time and capital to develop technologies in an industry that did not previously exist. AMTECH and its customers have been Commission licensees for many years, and have had licenses renewed by the Commission. Quite simply, AMTECH and numerous others have relied upon concepts contained in, and interpretations of, the existing rules, such as the forward-looking sharing environment established by those rules. Based on this regulatory scheme, multiple AVM providers have developed an industry that undeniably serves critical needs by contributing to enhanced transportation safety and efficiency. Thus far, AMTECH, its users, other such entrepreneurial entities and, ultimately, the public, have been well served.

Accordingly, PacTel has not made its case that the public is ill served by the current shared service rules. In fact, as detailed below, grant of the relief PacTel requests would actually impede development of AVM technology and frustrate other Federal policies. Not only would such an action violate the Commission's legislative mandate as declared in Sections 157(a) and 332(a) of the Act, it would as a practical matter enshrine virtually permanently a HML system of questionable technical merit.

B. Federal Policy Supports Systems such as AMTECH's

To the extent PacTel's plans imperil the types of services AMTECH and others provide in the band, its petition runs squarely counter to national policy as established both by the Executive Branch and the Congress. In fact, AMTECH's current system and future plans dovetail neatly with types of strategies that have already been found to be in the national interest.

Initially, in early 1990, the Department of Transportation (DOT) released its statement of national transportation policy. The document, Moving America: New Directions, New Opportunities,[57] presented a comprehensive review of the policy directions for transitioning U.S. transportation into the 21st century. DOT specifically addressed the type of AVM technology offered by AMTECH in several places. It recommended greater "toll financing" for Federal-aid highways.[58] In the report, DOT also discussed the efficiency gains from streamlining intermodal transport, and specifically urged "[g]reater standardization in billing and electronic data interchange" in order to "expedite movements and reduce costs."[59] Furthermore, the DOT report found that "automated tolling and billing using electronic systems for vehicle identification can save the cost and delay associated with conventional toll booths."[60]

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[57] U.S. Department of Transportation (Feb. 26, 1990) [hereinafter Moving America].

[58] Moving America, at 118.

[59] Id. at 72.

[60] Id. at 46-47.

As described above, AMTECH's current projects fit squarely within the Federal recommendations; indeed, AMTECH would have to be considered one of the leaders in developing the transportation systems of tomorrow.

Many of the DOT recommendations were codified in the Intermodal Surface Transportation Efficiency Act of 1991, which increased federal funding for highway and highway safety construction.[61] The law also included, for the first time, authorization to utilize federal highway grant funding for toll roads[62] plus funding for Congestion Pilot Pricing Programs to assess alternative methods for monitoring and reducing highway congestion.[63]

More importantly, the bill included the Intelligent Vehicle-Highway Systems Act of 1991.[64] That Act directed the Secretary of Transportation to:

> conduct a program to research, develop, and operationally test intelligent vehicle-highway systems and promote implementation of such systems as a component of the Nation's surface transportation systems.[65]

To this end, the Act established a number of goals, including encouraging:

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[61] Pub. L. No. 102-240, § 1003, 105 Stat. 1914, 1918, codified at 49 U.S.C. 101 note (Supp. III 1991).

[62] Id., § 1012.

[63] Id., § 1012(b).

[64] Pub. L. No. 102-240, § 6052, 105 Stat. 2189, codified at 23 U.S.C. § 307 note (Supp. III 1991).

[65] Id., § 6052(a).

- the widespread implementation of intelligent vehicle-highway systems to enhance the capacity, efficiency, and safety of the Federal-aid highway system. . .;

- the development and promotion of intelligent vehicle-highway systems and an intelligent vehicle-highway systems industry in the United States . . .; [and]

- the development of a technology base for intelligent vehicle-highway systems and the establishment of the capability to perform demonstration experiments. . ..[66]

The Act goes further and directs the Secretary of Transportation to "develop and implement standards and protocols to promote the widespread use and evaluation of intelligent vehicle-highway systems."[67]

AMTECH's system is precisely one of the types of IVHS technology that the Act seeks to encourage. The AMTECH system furthers the goals of the legislation, and is already being used to realize them. Indeed, AMTECH's AVM technology is deployed on over 400,000 vehicles involved with toll systems, railroads and other traffic applications to secure precisely the types of transportation efficiencies described in the Act.

In contrast, PacTel seeks to impair the ability of U.S. industry in general, and AMTECH in particular, to meet these objectives. AMTECH submits that the public interest does not support changes in communications policy that undermine other

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[66] Id., § 6052(b)(1, 4, 7).

[67] Id. § 6053(b). Moreover, the law requires the Secretary to "develop an automated highway and vehicle prototype," id., § 6054, and to measure a variety of traffic and environmental conditions, and make use of such data. Id., § 6056(b).

important federal policies.[68] For this reason as well, PacTel's petition should be dismissed.

C. The Relief PacTel Requests Would Retard, Not Spur, Growth in the AVM Marketplace

Despite the facial inconsistency with federal transportation policy, PacTel paints its request as one that will propel further AVM development. In fact, grant of the relief PacTel seeks would freeze AVM evolution, would unfairly grant it exclusive use of large portions of valuable spectrum and would involve the Commission in creating unnecessary and non-market driven distinctions among technology.

As described above, the existing rules have encouraged flexible AVM spectrum use. As drafted, Section 90.239 accommodates multiple AVM concepts and, thus, permits the market to encourage and select appropriate AVM technologies. The public has been well served by this AVM diversity, with the development of modulated backscatter technologies and HML systems. The current shared environment permits multiple entry and marketplace experimentation with several different technological approaches to perform the same functions and permits the public to choose from among technologies or, indeed, to select one type of technology for certain operations and another for different needs.

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[68] AMTECH does not suggest that it is the only system to further this nation's federal goals to improve transportation efficiency. Indeed, were PacTel's Teletrac system more robust and compatible with other users of the limited spectrum available for AVM, it might also contribute toward meeting the same federal objectives.

Grant of PacTel's requested relief, by contrast, would lock-in its technology -- at least in 8 MHz of the band -- to the exclusion of others.[69] Still worse, PacTel seeks a 16 MHz service duopoly, presumably to be shared with Ameritech's seemingly identical system. Pactel would thus totally foreclose the existing opportunity for experimentation and marketplace choice throughout much of the band and freeze AVM development in time. Doing so would "crowd-out" AMTECH and other users that can, under current FCC policies, gain access to most of the 902-928 MHz band, making less spectrum available. Of course, these are the transparent, and both anti-competitive and anti-public interest, goals of PacTel's petition.

Moreover, because PacTel has already "warehoused" spectrum for its installations by obtaining licenses in literally hundreds of locations, with a substantially lengthened schedule for actual system construction, PacTel would in effect be "pulling the ladder up" behind its system development. Under no compulsion to complete construction for ten years (under its proposal), PacTel would effectively foreclose all market entrants, even if they served different needs, or did so more rapidly or efficiently. Meanwhile, users such as the California Department of Transportation system will go unserved. Although this may inure to PacTel's private commercial advantage, it does not comport with the public interest.

As such, PacTel's plan would penalize systems, such as AMTECH's and others, that were engineered at significant expense to operate in a shared environment and

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[69] PacTel seeks a de facto nationwide allocation at 904-912 MHz plus 250 kHz at 925 MHz.

present minimal threat to co-frequency users. AMTECH could, of course, have sought similar exclusivity for its system. Instead, AMTECH chose to implement compliant technology fully capable of sharing and cooperating with virtually all other systems.

In addition, grant of PacTel's petition would set U.S. policy and regulation, and the AVM marketplace, at odds with the telecommunications policies of Canada and Mexico. As shown in Attachment F, Canadian authorities have already authorized AVM use in the 902-928 MHz band, including systems such as AMTECH's. Indeed, the mandatory AAR rail standards cover Canada and Mexico, and AMTECH technology has already been installed on numerous Canadian rail cars. The Mexican government is using AMTECH tags operating in the 902-928 MHz band on its national system of toll roads and 32 bridges on the United States-Mexico border.

Thus, the existing compatibility of North American systems, achieved with a minimum of controversy but providing enormous benefits to the globally-oriented transportation industry,[70] would be jeopardized by PacTel's request. Particularly when U.S. negotiators are even now attempting to secure the benefits of a North American Free Trade Agreement (NAFTA), the Commission should not impede the free flow of automobiles, rail cars and goods between the U.S. on the one hand and Canada and Mexico on the other.

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[70] Canada is the United States' largest market for export; Mexico is third. Dept. of Commerce, U.S. Foreign Trade Highlights at 11-18 (May 1992).

Finally, grant of PacTel's request would codify an unneeded distinction among technologies. As described above, the existing AVM rules were designed to be flexible and not to prejudge the development of particular AVM technologies. To this end, AMTECH designed a system that uses spectrum efficiently and is tolerant of co-frequency systems. This includes co-frequency systems such as PacTel that are authorized to use significantly higher power.[71]

AMTECH's technology -- and others like it -- make it clear that restricting large portions of the spectrum to HML systems, as suggested by PacTel, is unnecessary. AVM systems can and have been designed that are not only accurate but are "good neighbors" in spectrum usage. The fact that PacTel's system is far less fault tolerant and does not appear to be capable of coexisting with systems such as AMTECH's operating with less power should in no way entitle PacTel to limit 16 MHz of the band to just two systems. Indeed, grant of PacTel's request would be an unwarranted interference in a marketplace that is still developing without government interference.

In sum, the FCC's current forward-looking rules have promoted a wide variety of customer choice and technological development. Modifying them in the fashion suggested by PacTel could only thwart further progress and obstruct consumer alternatives.

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[71] AMTECH's readers typically radiate under 2 watts ERP, employ antennas that are frequently oriented below the horizon and typically operate from heights of twenty feet or less; PacTel's system is authorized to transmit at over 150 watts (1000 watts for the outbound channel), although there is some question about whether it actually operates at such levels. See infra note 82.

D. The PacTel Petition Would Benefit Few to the Detriment of Many

Current experience shows that the 902-928 MHz band can support numerous AVM approaches that meet critical user needs and facilitate important national objectives such as those codified in Section 7 of the Communications Act and in the Intelligent Vehicle-Highway Systems Act. PacTel's requested exclusivity, by contrast, seeks to strangle competition in the marketplace and replace it with regulatory fiat. This is not only an ill-advised course of action, it is inconsistent with the Commission-established pro-competitive regulatory philosophy.

PacTel's petition requests the creation of a duopoly for HML AVM.[72] Although the spectrum and rules can and do now support a larger and still undetermined number of entrants, PacTel seeks shelter from marketplace pressures to the extent of reducing to one the number of competitors. Particularly in frequencies that have never before been limited, the FCC should only with the greatest reluctance, and an enormous amount of proof, frustrate the market in such a fashion. Yet, PacTel in its petition dances lightly over this inevitable consequence of its request and provides little tangible evidence to support its plea for exclusivity other than weaknesses in its own system.

Indeed, PacTel's proposed rules would narrow access to the so-called wideband allocation still further. Although the current definition of AVM -- and PacTel's

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[72] PacTel's frequency plan is specifically designed to meet the needs of Teletrac and METS. See PacTel Petition at 22 n.32.

suggested revisions -- contemplate more than merely "ranging," PacTel's proposed definitions of "Wideband Pulse-Ranging Systems" would limit such systems to those actually locating objects.[73] Such a definition artificially and unnecessarily excludes systems such as AMTECH that could be used in IVHS applications that control vehicles or signs.

Moreover, given the existing licenses held by PacTel, and the licenses and pending requests for a virtually identical system offered by an Ameritech subsidiary (the METS system), PacTel's exclusive spectrum duopoly could easily become a duopoly of Regional Bell Operating Companies (RBOCs). Of course, the RBOCs have only recently been permitted to enter the information services marketplace.[74] Thus, it appears that PacTel's initial incursion into the information services marketplace consists of an attempt to expand its existing landline local exchange monopoly and impede competition. Such an effort is particularly inappropriate where, as here, the service is unrelated to telephone exchange offerings and exists in a market where competition is now flourishing both technologically and economically.

In addition, by seeking a restriction on entry after it had been licensed, PacTel would receive enormous private benefits. Indeed, it would receive protection for little more than "bare" licenses, thanks to a generous construction implementation schedule

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[73] PacTel Petition, Appendix 1 at 1.

[74] United States v. Western Electric Co., 767 F. Supp. 308 (D.D.C.), stay lifted, 1991-2 Trade Cas. (CCH) ¶ 69,610 (D.C. Cir.), appeal docketed, No. 91-5263 (D.C. Cir. Aug. 30, 1991).

already granted.[75] Although extensions of time to construct may have no serious regulatory significance in shared spectrum, they become a device for the speculation in, and warehousing of, spectrum in an exclusive use environment.[76] The Commission should thus consider whether tens or hundreds of applications, with a long-term extension of the construction period, followed by a request for exclusive use amounts to a scheme for spectrum speculation and could ever be in the public interest.

Finally, although PacTel's petition touts its system and includes testimonials from satisfied users, it omits mention of just how many customers it serves. It appears that -- even years after licensing -- the system in fact benefits relatively few. Industry sources suggest that PacTel is now likely to be serving less than 6000 subscribers.[77] By the nature of its system and the markets upon which it has focused, most of PacTel's users do not interact with the system on a daily basis.[78] In contrast, AMTECH's technology serves over 400,000 vehicles (including transportation equipment). In light of the AAR, ANSI, ISO, ATA and IATA standards, this number

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[75] See Letter to Carole Harris, Counsel for Teletrac, from Terry Fishel, Chief, Land Mobile Branch (March 23, 1989). Ameritech also appears to be operating under an extended implementation schedule.

[76] The ramifications of prolonging construction periods are quite different if the spectrum is assigned exclusively and, as a minimum, the Commission should reconsider those extensions were it to grant PacTel's petition. AMTECH and its customers, by contrast, have had only 8 months to construct their licensed systems.

[77] Cf. Inside IVHS at 7 (May 11, 1992) (noting that PacTel has installed 3,000 stolen vehicle systems in Los Angeles, its most mature market).

[78] PacTel has chosen initially to market its technology primarily as a means to track stolen vehicles, a use that does not require much interaction. As its Petition observes, the system also has other applications such as computer assisted dispatch.

is expected to increase substantially in the near future. Most of the end users of the AMTECH system rely on AMTECH AVM several times a week, if not daily, for well over 150 million transactions annually.

Attachment G contains several maps showing the distribution of PacTel and AMTECH systems. The first two maps compare current use: AMTECH has 1309 transmitters; industry sources suggest that PacTel has only 60.[79] The next two charts contrast all of PacTel's licensed, but unbuilt, systems with planned use of AMTECH technology by merely one industry segment: the North American railroads, which must complete installation on all rail cars by 1995. Even by this comparison, AMTECH will serve more customers. Accordingly, even if grant of PacTel's request were necessary to that system's continued operation, which AMTECH disputes, the balance of public use favors ensuring continued unimpeded operation -- including expanded deployment at both existing and new locations -- of systems such as AMTECH's.[80]

E. PacTel's AVM System is Spectrally Inefficient

Even if the Commission were to determine that AVM exclusivity was warranted, PacTel's system is a particularly poor one to be rewarded with large portions of valuable spectrum. PacTel seeks a regulatory fix to cure technological

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[79] Cf. FCC Master Frequency List Database for Los Angeles, Detroit, Chicago, Dallas and Miami.

[80] Indeed, the limited public usage of the PacTel system demonstrates the need for continued market experimentation before considering exclusivity.

deficiencies in its system. It is well known that spectrum exclusivity may be used to shield poor system design. Close examination suggests such a conclusion for several reasons.

First, PacTel requests a full 8 MHz for each HML system. Yet, elsewhere, PacTel's own technical materials demonstrate that its systems could be operated with far less bandwidth.[81] Moreover, AMTECH and its customers and users are already performing far more tag reads with far less spectrum and without preclusion of co-frequency systems. Other HML designs may as well.[82]

Second, the PacTel system is self evidently fragile. PacTel describes its system as spread spectrum using pseudo-random length codes (such as Gold codes) for code discrimination. As the Commission well knows, spread spectrum technology is often employed to provide additional communications in noisy environments.[83] Code division multiple access (CDMA) using Gold codes typically provides an additional

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[81] See, e.g., Application of PacTel Teletrac of Inglewood California, FCC File No. 338686, Exhibit B at 2 (filed Jan 7, 1992) (hereinafter Inglewood Application) ("The radiolocation system will use a bandwidth between 2 and 8 MHz.")

[82] There is an inconsistency between PacTel's interference analysis and its licenses that makes actual interference potential hard to assess. In several places in the petition, PacTel asserts that its mobile units currently transmit with approximately 5 watts of power or less. E.g., PacTel Petition, Appendix 2, at 18. Yet PacTel's licenses authorize up to 158 watts ERP for its mobile units. E.g., Inglewood Application, Form 574. The Commission should seek clarification regarding PacTel's operation and future plans.

[83] See Spread Spectrum Systems, 5 F.C.C. Rcd 4123, 4123 (1990) (spread spectrum systems can "suppress undesired signals, thereby enabling such systems to tolerate strong interfering signals."); Taub & Schilling, Principles of Communications Systems, 721 (2d ed. 1986) ("In the commercial communications field spread spectrum has many applications [including] the transmission of a spread spectrum signal on the same carrier frequency as an already existing microwave signal. By communicating in this manner additional signals can be transmitted over the same band thereby increasing the number of users."). See generally R. Dixon, Spread Spectrum Systems (2d ed. 1984).

level of freedom from interference.[84] Indeed, the agency has long recognized that combining spread spectrum with pseudo-random codes can permit spectrum sharing and entry by several systems.[85] Yet, somehow, PacTel has adopted a design with both characteristics but without any ability to share spectrum.

Given PacTel's system fragility, the Commission has no assurance that the system could operate properly in the presence of the primary ISM equipment or government radiolocation services.[86] In fact, PacTel's fixation on exclusivity calls into question whether already authorized Part 15 systems could threaten the integrity of PacTel's system. Granting exclusivity to PacTel now could easily result, a few years later, in a follow-on request to delete the amateur allocations or Part 15 authority.[87]

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[84] Taub & Schilling, at 726 ("The advantage of a CDMA system is that collisions are not destructive, i.e., each of the signals involved in a collision would be received with only a slight increase in error rate.").

[85] Spectrum Efficiency in the Private Land Mobile Radio Bands in Use Prior to 1968, 6 F.C.C. Rcd 4126, 4131 (1991) ("Spread spectrum systems offer two important advantages over conventional transmission schemes [including the fact that they] are able to tolerate strong interfering signals."); Radiodetermination Satellite Service, 104 F.C.C.2d 650, 655 n.18 (1986) ("spread spectrum techniques are superior to [other designs in that] multiple entry may be accomplished.").

[86] PacTel provides no substantive analysis of the potential for interference to its system from ISM and Part 15 devices.

[87] The interference analysis attached as Appendix 2 to its Petition strongly suggests that PacTel needs an extraordinarily quiet RF environment over a very large area. Although amateur and Part 15 operations are secondary to AVM, both are premised on the assumption that the Commission need not control the number and locations (except for certain amateur operations in Colorado and Wyoming) of such users to avoid interference to primary allocations. PacTel's own materials cast doubt on the application of this premise in this instance and indicate that grant of the Petition necessarily would result either in widespread and continual electromagnetic compatibility problems or further regulatory confrontations.